Academic Council Meeting No. and Date: 9 / July 02, 2024

Agenda Number: 3 Resolution Number: 41, 42/3.17 & 3.37

Vidya Prasarak Mandal's

B. N. Bandodkar College of Science (Autonomous), Thane

Syllabus for

Programme: Master of Science

Specific Programme:

BIODIVERSITY, WILDLIFE CONSERVATION & MANAGEMENT

[BWCM]

[M.Sc. (Semester III and IV)]

Level 6.0 and 6.5

CHOICE BASED GRADING SYSTEM

Revised under NEP and Autonomy

From academic year 2024-25

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Sr. no	Heading	Particulars
1	**Title of the course**	**M.Sc. in Biodiversity, Wildlife Conservation and Management**
2	**Eligibility for Admission**	● 4 year integrated B.Sc. in ANY subject/ Biological Sciences or its equivalent. ● PG Diploma in Biodiversity, Wildlife Conservation and Management
3	**Passing Marks**	**40%**
4	**Ordinances/Regulations (if any)**	**Nil**
5	**No of Years/Semesters**	**Two years, Four semesters**
6	**Level**	**P.G. 6.0 & 6.5**
7	**Pattern**	**Semester**
8	**Status**	**Revised under Autonomy as per NEP 2020**
9	**To be Implemented from Academic Year**	**2024-25**

BOS Chairperson: Dr. Urmila Kumavat

B. N. Bandodkar College of Science, (AUTONOMOUS)-Thane

Master program in Biodiversity, Wildlife Conservation and Management

Year (2 Yrs)	LEVEL	SEMESTER	Major				Research Methodology	On Job Training / Field project	Research project	Cum Credits	Degrees
			Mandatory		Electives anyone						
I	6.0	SEM-I	**3*4 + 2 = 14**		Credits 4		**Credits 4**	NA	NA	22	PG Diploma in Biodiversity, Wildlife Conservation and Management (After 3 Yrs. degree UG)
			Course 1	Credits 4	Course 1= Credits 4						
			Course 2	Credits 4	**OR**						
			Course 3	Credits 4	Course 2 = Credits 4						
			Course 4	Credits 2	**OR**						
		SEM-II	Course 1	Credits 4	Course 1 = Credits 4		NA	**Credits 4**	NA	**22**	
			Course 2	Credits 4	**OR**						
			Course 3	Credits 4	Course 2 = Credits 4						
			Course 4	Credits 2	**OR**						
Cum Cr.for 1 Yr. PG Diploma			**28**		8		4	4		44	
II	6.5	SEM- III	Course 1	Credits 4	Course 1	Credits 4	NA	NA	**Credits 4**	22	Master program in Biodiversity, Wildlife Conservation and Management (After 3 Yrs. degree UG)
			Course 2	Credits 4	**OR**						
			Course 3	Credits 4	Course 2	Credits 4					
			Course 4	Credits 2	**OR**						
		SEM IV	Course 1	Credits 4	Course 1	Credits 4	NA	NA	**Credits 6**	**22**	
			Course 2	Credits 4	**OR**						
			Course 3	Credits 4	Course 2	Credits 4					
					OR						
Cum Cr. for integrated 1 Yr. PG Degree				**26**	**8**				**10**	**44**	
Cum Cr. for 2 Yr. PG Degree				**44**	**16**		**4**	**4**	**10**	**88**	

PREAMBLE

The potential source of income for the nation is its biodiversity, which is woefully underutilized. The shortage of skilled laborers is one of the causes of underutilization. Taxonomists and ecologists who prefer the field and functional and molecular biologists who prefer the lab make up the majority of the current generation of biologists. This gap has grown to be a barrier to understanding biodiversity. By concurrently encouraging expertise in field and lab biology, the current approach aims to close the gap. This capacity-building activity will contribute to the creation of wealth through making responsible and sustainable use of the nation's bio resources. The two-year postgraduate program M. Sc. Biodiversity Wildlife Conservation and Management consists of four semesters. The vitally important subject of biodiversity is covered comprehensively in the syllabus proposed below.

The course is divided into four semesters: the first year, which consists of two semesters, is heavily focused on the field, while the second year is focused on the lab as well as field.

First semester consists of ecology and plant and animal diversity. Second semester focuses on conservation biology which is a need of an hour. It will help students become a competent naturalist and ecologist because they place equal emphasis on conceptual and empirical knowledge of how natural systems function.

Third and Fourth semester comprises crucial topics like study of ecotourism, wildlife forensics, acts and laws of environment and wildlife, environmental journalism etc. It will expose students to apply and utilize the knowledge gained in the first year of the course and learn some new techniques for future use.

➢ PROGRAMME OUTCOMES (POs) OF MASTERS IN SCIENCE (M.Sc.)

The Postgraduate Programmes of Science are intended to cater quality education and attain holistic development of learners through the following programme outcomes:

PO1 – Domain Knowledge
Comprehend and demonstrate domain knowledge in specialized branch of science. Instil ability to apply it in upgrading professional, social and personal life.

PO2 – Development of Research Competence
Imbibe skills related to identification of research problem, formulating hypothesis, execution of research process, analysing data, interpreting the data, drawing conclusion and presenting research work. Encourage learners for doctoral studies.

PO3 - Digital Literacy
Enhance ability to access, select and use a variety of relevant information e-resources for creating new knowledge resources.

PO4 - Sensitization towards Environment
Build cohesive bond with nature by respecting natural resources, encouraging eco-friendly practices and creating awareness about sustainable development.

PO5 - Individuality and Team work
Encourage learner to work independently or in collaboration for achieving effective results through practical experiments, project work and research activities.

PO6 – Competence for Employment
Promote field work, internships, industrial training, research projects, research paper presentations and publications to develop competence for adapting towards dynamic socio-economic changes and make learner employable.

Eligibility:

- B.Sc in ANY subject or its equivalent.
- B.Sc. Veterinary Science or its equivalent.
- B.Sc. Agriculture OR Forestry or its equivalent.

Duration: 2 years (Level 6.0 and 6.5)

Mode of Conduct: Laboratory practicals / Offline lectures / Online lectures

Total Credits for the Program: 88

Starting year of implementation: 2024-25

➢ PROGRAM SPECIFIC OUTCOMES (PSOS) FOR MSC BIODIVERSITY, WILDLIFE CONSERVATION AND MANAGEMENT

PSO1: Comprehend Fundamental Concepts in Biodiversity and Ecology (linked to PO1) Recall and understand foundational concepts related to biodiversity, ecological dynamics, environmental regulations, and plant and animal diversity to establish a strong knowledge base. **[Bloom's Level:** L1 (Remembering), L2 (Understanding)]

PSO2: Apply Scientific Principles, Technological Tools, and Conservation Strategies (linked to PO3, PO6)
Utilize field techniques, bioanalytical tools, digital technologies such as GIS and RS, and wildlife management strategies to implement effective and practical conservation practices. **[Bloom's Level:** L3 (Applying)]

PSO3: Develop Research and Analytical Competence (linked to PO2) Formulate research hypotheses, design experiments, analyze data using biostatistical methods, and interpret results to address biodiversity and conservation challenges effectively. **[Bloom's Level:** L3 (Applying), L4 (Analyzing)]

PSO4: Analyze and Mitigate Conservation and Human-Wildlife Conflict Issues (linked to PO4) Assess ecological patterns, human-wildlife conflicts, and socio-economic challenges, and propose evidence-based solutions through the evaluation of relevant data and scenarios. **[Bloom's Level:** L4 (Analyzing), L5 (Evaluating)]

PSO5: Demonstrate Proficiency in Legal, Ethical, and Forensic Aspects (linked to PO5, PO6) Apply legal frameworks, including Intellectual Property Rights (IPR), wildlife forensics, and environmental regulations, alongside ethical principles to ensure integrity and accountability in conservation practices. **[Bloom's Level:** L5 (Evaluating)]

PSO6: Innovate and Promote Sustainability through Multidisciplinary Approaches (linked to PO4, PO6)
Synthesize knowledge from biodiversity, transgenics, artificial intelligence, and environmental science to design initiatives for eco-literacy, sustainable development, and innovative conservation efforts. **[Bloom's Level:** L5 (Evaluating), L6 (Creating)]

ASSESSMENT: WEIGHTAGE FOR ASSESSMENTS (IN PERCENTAGE) FOR MANDATORY AND ELECTIVE COURSE

Type of Course	Formative Assessment / Internal Assessment	Summative Assessment
Theory	40%	60%
Practical	-	100%

Internals Based on Unit 1 / Unit 2 / Unit 3/ Unit 4

Assignments/ Tutorials	Seminar	Ppt/video Presentation	Group discussion	Active Participation & Leadership qualities	Total
10	10	10	05	05	40

VPM's B. N. Bandodkar College of Science (Autonomous), Thane
M.Sc. in Biodiversity, Wildlife Conservation and Management
Structure of Programme

Class	Sem	Course type	Course Code	Course Title	Credits
Part 2	SEM 3	**MANDATORY**	24BPBW3T01	Fundamentals of Microbiology, Transgenics and Phylogenetics	4
			24BPBW3T02	Techniques of Wildlife Management and Biostatistics	4
			24BPBW3T03	Applications of Information Technology in Field Biology	4
			24BPBW3P01	Practicals based on 24BPBW3T01, 24BPBW3T02, 24BPBW3T03	2
		ELECTIVE	24BPBW3T04	Monitoring and Assessing Environment	2
			24BPBW3P02	Practicals based on 24BPBW3T04	2
			OR		
			24BPBW3T05	Intellectual Property Rights (IPR) for Biodiversity and Wildlife	2
			24BPBW3P03	Practicals based on 24BPBW3T05	2
			24BPBW3RP3	Research Project – I based on Biodiversity, Wildlife Conservation and Management	4
				Total	22
	SEM 4	**MANDATORY**	24BPBW4T01	Important Acts, Regulations and Organizations	4
			24BPBW4T02	Human Wildlife Conflicts and Mitigation	4
			24BPBW4T03	Wildlife Forensic Science	4
		ELECTIVE	24BPBW4T04	Eco Journalism and Eco Literacy	2
			24BPBW4P01	Practicals based on 24BPBW4T04	2
			OR		
			24BPBW4T05	Biodiversity and Artificial Intelligence	2
			24BPBW4P02	Practicals based on 24BPBW4T05	2
			24BPBW4RP3	Research Project – II based on Biodiversity, Wildlife Conservation and Management	6
				Total	22
TOTAL SEM 3 & SEM 4					**44**

Mode of Conduct: Laboratory and field practical / Offline / Online / Hybrid mode

VPM's B.N. Bandodkar College of Science (Autonomous), Thane

Curriculum Structure for the Post Graduate Degree Programme M.Sc. Biodiversity, Wildlife Conservation and Management (Part I)

	SEMESTER - III	**Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)**			**Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)**			
Course Code	**Mandatory Course Title**	**EM**	**EN**	**SD**	**PE**	**GE**	**HV**	**ES**
24BPBW3T01	Fundamentals of Microbiology, Transgenics and Phylogenetics	✓	-	✓	-	-	-	-
24BPBW3T02	Techniques of Wildlife Management and Biostatistics	✓	-	✓	-	-	-	✓
24BPBW3T03	Applications of Information Technology in Field Biology	✓	-	✓	-	-	-	-
24BPBW3P01	Practicals based on 24BPBW3T01, 24BPBW3T02, 24BPBW3T03	✓	-	✓	-	-	-	✓
	Elective Course Title							
24BPBW3T04	Monitoring and Assessing Environment	✓	✓	✓	-	-	-	✓
24BPBW3P02	Practicals based on 24BPBW3T04	✓	✓	✓	-	-	-	✓
	OR							
24BPBW3T05	Intellectual Property Rights (IPR) for Biodiversity and Wildlife	✓	✓	✓	-	-	-	✓
24BPBW3P03	Practicals based on 24BPBW3T05	✓	✓	✓	-	-	-	✓
	Research Project							
24BPBW3RP3	Research Project – I based on Biodiversity, Wildlife Conservation and Management	✓	-	✓	-	-	-	✓
09	Total	09	04	09	00	00	00	07

	SEMESTER - IV	Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)			Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)			
Course Code	**Mandatory Course Title**	**EM**	**EN**	**SD**	**PE**	**GE**	**HV**	**ES**
24BPBW4T01	Important Acts, Regulations and Organizations	-	-	✓	-	-	-	✓
24BPBW4T02	Human Wildlife Conflicts and Mitigation	-	✓	✓	-	-	✓	✓
24BPBW4T03	Wildlife Forensic Science	✓	-	✓	-	-	✓	✓
	Elective Course Title							
24BPBW4T04	Eco Journalism and Eco Literacy	✓	✓	✓	-	-	-	✓
24BPBW4P01	Practicals based on 24BPBW4T04	✓	✓	✓	-	-	-	✓
	OR							
24BPBW4T05	Biodiversity and Artificial Intelligence	✓	-	✓	-	-	-	✓
24BPBW4P02	Practicals based on 24BPBW4T05	✓	-	✓	-	-	-	✓
	Research Project							
24BPBW4RP3	Research Project – II based on Biodiversity, Wildlife Conservation and Management	✓	✓	✓	-	-	-	✓
08	Total	06	04	08	00	00	02	08

Dr. Urmila Kumavat
BOS Chairman & Coordinator, Dept. of Biodiversity, Wildlife Conservation & Management

NOTE:

- In teaching-learning case study needs to illustrate wherever required.
- Current scenario should collaborate with the syllabus
- Field visits to nearby zoo, museum/forest/sea- shore/ nursery/ aquaria/ or any other relevant site. The report of these visits will be submitted as part of the practical work.

SEMESTER I
MANDATORY

Course Code 24BPBW3T01	Course Title Fundamentals of Microbiology, Transgenics and Phylogenetics	Credits 04	No. of lectures 60

Course Outcomes:

At the end of the course students will be able to:

CO 1	Classify microorganisms based on morphology, ecology and biochemistry	L2
CO 2	Explain the principles and techniques of rDNA technology	L2
CO 3	Assess the applications, ecological effects, and potential threats of genetically modified organisms in agriculture and animal husbandry.	L5
CO 4	Examine phylogenetic methods, molecular evolution, sequencing techniques, and evolutionary theories	L4

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	1	2	1	2
CO 2	3	3	2	1	1	3
CO 3	3	2	1	3	2	3
CO 4	3	3	2	2	1	3

Unit I:	**Microbial Diversity**	**15**
	• Microbes and Earth history • Classification of microorganisms (Bacteria, Viruses, Protists) • Major classes of bacteria of ecological, agricultural and environmental importance • Micro-organisms in extreme environments (eg: temperature, pH, oxygen) - Actinomycetes, Cyanobacteria, Myxobacteria, Mycoplasma, Spirochetes • Biochemical characterization- Gram Character, Enteric bacteria, Aerobic and Anaerobic bacteria	
Unit II:	**Recombinant DNA technology**	**15**
	• DNA isolation, cDNA synthesis • DNA probes, Oligonucleotide synthesis • Vectors - Plasmids (natural and artificial), Phage, Cosmid, BAC, YAC • Transformation of Viruses and Bacteria - process • Introduction of foreign DNA into animal cells & plant cells • Stability of recombinant organisms (concept of mutational rates)	
Unit III:	**GMOs and their applications (Agriculture & Animal husbandry)**	**15**

	• Trans-genesis and Genetically Modified Organisms • Ecological effects and Potential threats • Field trials • Some success stories - insect and herbicide resistant crops, transgenic farm animals	
Unit IV:	**Molecular Evolution and Phylogenetics**	**15**
	• Phylogenetics - general concepts, types of cladogram, phylograms and phenograms, application • Molecular evolution - general concepts, mutation and its types, application • Nucleotide sequencing - concepts of Sanger, Next Gen sequencing • Amino acid sequencing - concepts of Edman degradation, Mass spectrometry • Molecular Evolutionary Clock & Neutral theory of molecular evolution	

Course Code 24BPBW3T02	Course Title Techniques of Wildlife Management and Biostatistics	Credits 04	No. of lectures 60

Course Outcomes:

At the end of the course students will be able to:

CO 1	Inspect principles of wildlife management and habitat enhancement techniques	L4
CO 2	Examine community participation and resource-sharing strategies in managing protected areas.	L4/L2
CO 3	Interpret statistical methods and graphical representations to analyze biological data.	L5
CO 4	Evaluate statistical tests for hypothesis validation and data interpretation.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	1	3	1	2
CO 2	3	2	1	3	3	2
CO 3	2	3	2	1	1	3
CO 4	2	3	2	1	1	3

Unit I:	**Principles and Techniques of Wildlife Management**	**15**
	• Census and enumeration of populations • Prey-predator ratio • Habitat management - Plantations, nesting places • Nesting materials, Hides & shelters • Census & enumeration of species • Improving carrying capacity • Water holes, salt licks, stall feeding, Controlled grazing, controlled fire, Culling & translocation	
Unit II:	**People's participation in managing protected areas**	**15**
	• Integrating Local Community in conservation • Training & skill development of local human resource • People's Biodiversity Register and Critical Wildlife Habitat Interpretation Centers & Interpretation to visitors • Hospitality & Conducted tours • Resource sharing & income sharing • Case studies: (e.g. Ranthambore, Periyar, Lakswadweep, Van samitis, Kaziranga, Eagles Nest, Nagaland- Amur Falcon, Andaman- Edible Nest Swiftlets)	
Unit III:	**Basic Statistics for field biology**	**15**

	● Concept of Sample and Population, Determining sample size ● Types of Data (Qualitative and quantitative and their subtypes) and its distributions: (Normal, Binomial, and Poisson) Graphical representation (Pie, bar, line, histograms, frequency polygons, Kite diagrams etc.) ● Measures of central tendencies and Measures of dispersion ● Type I and II errors (problems based on above methods)	
Unit IV:	**Advanced Statistics for field biology**	**15**
	● Null Hypothesis and Hypothesis testing ● Working on quantitative and qualitative data: ● Parametric Tests: Z, t, F, ● Non-Parametric Tests: Chi-Square, ● Correlation and Regression analysis and its applications. ● Concepts of Confidence interval and Power (problems based on above methods)	

Course Code **24BPBW3T03**	**Course Title** **Applications of Information Technology in Field Biology**	**Credits** **04**	**No. of lectures** **60**

Course Outcomes:

At the end of the course students will be able to:

CO 1	Assess field technologies and telemetry applications for wildlife monitoring and research.	L5
CO 2	Interpret audio recording techniques and their applications in ecological monitoring.	L2/L 5
CO 3	Utilize GIS and GPS technologies to develop field maps and analyze biodiversity data.	L3
CO 4	Apply remote sensing principles and software tools to interpret biodiversity-related data	L3

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	2	2	2	3
CO 2	3	2	2	2	2	3
CO 3	3	3	3	3	2	3
CO 4	3	3	3	3	2	3

Unit I:	**Field computers and Radio-telemetry**	**15**

Course Code 24BPBW3P01	PRACTICALS BASED ON 24BPBW3T01, 24BPBW3T02, 24BPBW3T03	Credits 02	No. of lectures 60
Course Outcomes: At the end of the course students will be able to:	• Various restraining, capture techniques and types of cages for animals. • Various telemetry devices (including data loggers) • Ethics in telemetry applications		
	• Hand held & satellite based systems • Limitations of telemetry observations • Applications of telemetry eg. Habitat usage, migration studies • "Digital" tagging & its applications (e.g. implanting microchips)		
Unit II:	**Audio records**		**15**
	• Various audio recording techniques • Sonogram and its evaluation • Software for sonogram evaluation • Applications of audio recordings e.g. (Bird songs, Insect calls, Habitat usage by Bats, Marine mammals) • Managing data integrity & safety in field		
Unit III:	**GIS and its interpretation**		**15**
	• GIS: Basic principles and significance • Types of Geographical Data; Data Structure; Vector and Raster data: their Advantages and Disadvantages • Satellite imagery, False color composition • Applications of Geographic Information System • Concept of database and metadata • Importance of GIS in Biodiversity studies • GPS and its application in field • Preparation of field maps, vegetation map		
Unit IV:	**Remote Sensing**		**15**
	• Principles, basic concepts and applications of Remote Sensing • Software for Remote Sensing: Q-GIS, Arc GIS, SAGA, DIVA GIS, US GIS, BHUVAN • Aerial photography - Basics and principles • Case studies - Use of Remote sensing in Biodiversity studies		

CO 1	Make use of basic microbiological and molecular techniques.	L3
CO 2	Interpret data from phylogenetics, population studies, and statistics.	L4
CO 3	Identify signs of wildlife using field-based evidence.	L3
CO 4	Utilize field and digital tools for ecological monitoring.	L3

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	2	2	1	3
CO 2	3	3	2	1	1	3
CO 3	3	2	1	3	2	3
CO 4	3	3	3	3	2	3

1. Aseptic transfer technique
   - inoculation and culturing of microorganisms
   - isolation techniques - serial dilution and T streak, Quadrant
   - Gram staining
2. Extraction of chromosomal/plasmid DNA from bacteria.
3. Problems based phylogenetic maps and Cladograms. (Eg. Describe/Comment on evolutionary history/ patterns in the picture etc.)
4. Identification of a) Techniques of Trangenesis and b) Genetically Modified Organisms, using suitable photographs.
5. Demonstrate the capture – recapture technique for enumeration of population size (e.g. rice weevil or beads/seeds using - marker pen)
6. Study of Pugmarks: Make plaster cast of pugmark (e.g. of domestic cat or dog). From the plaster cast make measurements and record the same. Trace the pug mark using glass slab and make a record. Take measurements and keep a record. Study the applications of the same.

   If possible, repeat the experiment with Plaster cast of pug mark of Tiger / Leopard (take help from Wildlife authority to obtain plaster casts)
7. Study of animal Tracks & signs using photographs or drawings. e.g. pugmarks, foot prints, tracks,

   claw marks, browse lines, regurgitates (e.g. owls), hair, burrows, dens, nests etc.
8. Study of excreta/faeces of various animal species using specimens (if feasible) photograph or images. It should include different kinds of excreta eg. Scat, Dropping, Pellet, Dung, spraint, Guano etc. (The concept and significance of coprology should be understood by studying various types of scats and their natural decay process.)
9. Problems based on statistical tools in theory. Statistics using MS-EXCEL
10. Identify and study applications of components of a typical field kit.
11. Identify and study specifications & applications of various telemetric devices (Photographs or Models or working models and diagrams);
    a. Antennae, transmitters (ingestible, implantable, strap-on (attachable) type)
    b. Digitized tags (e.g. implantable micro chips)
    c. Dart Gun & Tranquilizing agents & their action.
12. Make an audio recording of a song bird. e.g., bulbul, magpie robin, sunbird. Observe and note the activity of the bird while recording the call. Make a sonogram of the recording. Analyze the call and correlate with the behavioral observations. Classify the call as advertisement call, territorial call, alarm call, courtship call etc.
13. Study of various input devices (construction, use and applications) using photographs /

	models / actual devises, that could be used with a field computer ; 14. Types of input ports, Imaging devices, audio devices, Telemetric devices, Note pads & scribble pads, pressure devices, Remote control devices, external memory devices etc. 15. Using a hand held GPS instrument locate coordinates of a demarcated field site (Eg. college campus). 16. Describe the use of any of the following software platforms by performing basic operational/ statistical functions: Maxent/ PAT GEOM/ Rstudio. (Simulated datasets can be used. Basic programming in R should be attempted for simple statistical calculations.) Students should understand the basics of coding and syntax. The application of such platforms in ecosystem modeling should be understood. Simple programs and analysis carried out should be recorded as a report. **Any 10 practicals from the above list to be performed	

SEMESTER III
ELECTIVE I

Course Code 24BPBW3T04	Course Title Monitoring and Assessing Environment	Credits 02	No. of lectures 30

Course Outcomes:

At the end of the course students will be able to:

CO 1	Interpret abiotic and biotic parameters to assess habitat health across diverse ecosystems.	L5
CO 2	Distinguish between monitoring methods based on seasonal and continuous ecological assessments.	L4
CO 3	Design environmental audits by selecting suitable assessment types and key biotic and abiotic parameters.	L6
CO 4	Compile audit findings to demonstrate the significance and applications of environmental and carbon audits.	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	2	3	2	3
CO 2	3	2	2	3	1	2
CO 3	3	3	3	3	2	3
CO 4	3	3	3	3	2	3

Unit I:	**Monitoring Environment**	**15**
	● Abiotic parameters to be monitored for various types of habitats - air, soil, water ● Biotic parameters - Keystone species & Indicator species ● Continuous & seasonal monitoring ● Various monitoring techniques & methods	
Unit II:	**Environmental Audits & reporting**	**15**
	● Types of assessment ● Planning environmental audits ● Audit parameters: major biotic and abiotic factors ● Environment safety audits, Carbon Audits, its significance, applications and practice ● Reporting audit findings ● Predictive value of audit findings	

Course Code 24BPBW3P02	PRACTICALS BASED ON 24BPBW3T04	Credits 02

Course Outcomes:

At the end of the course students will be able to:

CO 1	Determine physical and chemical properties of soil samples.	L5
CO 2	Evaluate key water quality parameters through laboratory tests.	L5
CO 3	Design audits to assess energy and water usage.	L6
CO 4	Interpret environmental data for resource conservation insights.	L5/L 2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	2	3	2	3
CO 2	3	3	2	3	2	3
CO 3	3	3	3	3	2	3
CO 4	3	3	3	3	2	3

1) Test of Soil samples for -
   - pH
   - Texture
   - Total organic content.
2) Test of Water samples for -
   - Dissolved Oxygen
   - BOD
   - Light Penetration
   - Salinity
   - pH
   - Hardness,
   - Total Dissolved Solids and Total Suspended Solids
3) To perform energy/water audit from lab/house/building/office

SEMESTER III
ELECTIVE II

Course Code 24BPBW3T05	Course Title Intellectual Property Rights (IPR) for Biodiversity and Wildlife	Credits 04	No. of lectures 30

Course Outcomes:

At the end of the course students will be able to:

CO 1	Discuss the role, history, and governance of Intellectual Property Rights (IPR) in promoting economic and cultural development.	L6
CO 2	Identify key categories of IPR and their protection frameworks in India.	L3
CO 3	Outline the conditions, rights, and limitations related to patent protection and infringement in India.	L2
CO 4	Summarize the steps of the patenting process, application types, and the concept and consequences of biopiracy.	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	2	2	1	3
CO 2	3	2	2	2	1	3
CO 3	3	2	2	2	1	3
CO 4	3	3	2	3	1	3

Unit I:	**Introduction to Intellectual Property Rights**	**15**

	● Tangible & intangible properties
	● Definition of IP and IPR, Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP, History of IP in India
	● Categories of Intellectual Property:
	  ● Copyrights and Related Rights -Classes of Copyrights, Criteria for Copyright, Ownership of Copyright, Copyright Infringement is a Criminal Offense, Validity of Copyright
	  ● Trademarks- Eligibility Criteria, Designation of Trademark Symbols, Classification of Trademark, Acts and Laws, Validity of Trademark
	  ● Geographical Indications- Acts, Laws and Rules Pertaining to GI, Rights Granted to the Holders, GI Ecosystem in India
	  ● Trade Secrets- Criteria for Trade Secret, Rights Associated with Trade Secrets, Important Information about Trade Secrets
	  ● Plant Varieties- Need for Native Plant Protection as an IP, Indian Context for Protection of Plant Varieties, Duration of Plant Variety Protection in India
	  ● Industrial Designs- Eligibility Criteria, Acts and Laws to Govern Industrial Designs, Design Rights, Duration of the Registration of a Design	

Unit II:	**Patenting**	**15**

- Introduction to patent, Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention,
- Rights Associated with Patents, Enforcement of Patent Rights, Inventions Eligible for Patenting, Non-Patentable Matters, Patent Infringements, Avoid Public Disclosure of an Invention before Patenting
- Process of Patenting:
  - Prior Art Search, Choice of Application to be Filed
  - Patent Application Forms, Jurisdiction of Filing Patent Application, Publication, Pre-grant Opposition, Examination, Grant of a Patent, Validity of Patent Protection,
  - Post-grant Opposition Commercialization of a Patent, Patent Related Forms,
- Types of Patent Applications, National Bodies Dealing with Patent Affairs, Utility Models
- Biopiracy – concept, impacts (eg: Neem, Basmati etc)

Course Code 24BPBW3P03	**PRACTICALS BASED ON 24BPBW3T05**	**Credits 02**

Course Outcomes:

At the end of the course students will be able to:

CO 1	Compile and draft basic patent application forms and specifications following procedural guidelines.	L6
CO 2	Interpret real-life examples of copyright, trademark, GI, patent, and trade secret through case studies.	L5
CO 3	Summarize the significance of Intellectual Property Rights through expert interactions and events.	L2
CO 4	Distinguish various forms of IPR based on legal features and real-world applications.	L4

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	2	2	2	3
CO 2	3	2	2	2	2	3
CO 3	3	2	2	2	3	3
CO 4	3	2	2	2	1	3

1. Filling a Patent: Form-1 (application for the grant of a patent).
   Form-2 (provisional/complete specifications).
2. Case study and examples on copyright
3. Case study and examples on trademark
4. Case study and examples on Geographical Indicators
5. Case study and examples on trade secret
6. Case study and examples on patent
7. Attending a workshop/seminar/Conference/Guest lecture on IPR.

Course Code 23BPBW3RP3	Course Title RESEARCH PROJECT – I based on Biodiversity, Wildlife Conservation and Management	Credits 04	No. of Hours: 120

SEMESTER IV
MANDATORY

Course Code 24BPBW4T01	Course Title Important Acts, Regulations and Organizations	Credits 04	No. of lectures 60

Course Outcomes:

At the end of the course students will be able to:

CO 1	Interpret global conventions on biodiversity conservation and sustainable resource management.	L5
CO 2	Design appropriate methodologies and sampling techniques for data collection in the field.	L6
CO 3	Analyze the collected field data using suitable statistical tools.	L4
CO 4	Discuss the research findings effectively through reports and oral presentations.	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	2	1	2	3
CO 2	3	3	2	2	3	3
CO 3	3	3	3	2	2	3
CO 4	3	3	3	2	3	3

General Guidelines

1. The RP topic may be undertaken from any topic relevant to biodiversity, ecology, conservation and allied subject with precise objective
2. Each student has to undertake a RP individually based on field and/or laboratory work
3. Students must remain present at the time of review meeting scheduled by research guides
4. Structure of report should contain the following chapters: Title, Abstract, Aim, Objective and Rationale, Introduction, Literature review, Methodology, Study Area, Observations, Result, Conclusion, Discussion, Bibliography
5. Student should prepare a powerpoint presentation of research project and it should be presented in front of respective examiner
6. Duly signed hard copy of report and PPT should be submitted to the Department/college

CO 2	Outline key forest-related regulations and acts and their role in wildlife and biodiversity conservation.	L2
CO 3	Explain the acts and policies governing protected areas and their implications for biodiversity conservation.	L2
CO 4	Summarize key measures, international conventions, and institutions that regulate and control wildlife trade and crime.	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	2	3	2	2
CO 2	3	2	2	3	2	2
CO 3	3	2	2	3	2	2
CO 4	3	2	2	3	2	2

Unit I:	**Conventions on Conservation**	**15**
	• Convention on Biodiversity (CBD) • Cartagena Protocol on Biosafety • World Heritage Convention • Ramsar Convention on Wetlands • Bonn Convention • International Tropical Timber Agreement • Convention on Desertification	
Unit II:	**Regulations & Acts related to forests**	**15**

	• Wildlife Protection act, 1972
	  • Role of National Board of Wildlife (NBWL)
	• Biodiversity Act, 2002
	  • Role of National Biodiversity Authority (NBA), State Biodiversity Board (SBB), Biodiversity Management Committee (BMC)
	• Forest conservation Act, 1980
	• Indian Forest Act, 1927
	• Forest Rights Act	

Unit III:	**Regulations & Acts related to protected areas**	**15**
	• Tribal Rights Act, 2006 • Coastal Regulatory Zone notification, 1991 • Wetland Rules • Fisheries Act, 1897 • Prevention of Cruelty to Animals Act, 1960 • National Afforestation Programme (NAP)	

	● Integrated Development of Wildlife Habitats (IDWH)	
Unit IV:	**Wildlife trade and related organizations**	**15**
	● Measures to control poaching & wildlife trade ● CITES ● RED Data Book ● Wildlife Crime Control Bureau ● International Consortium on Combating Wildlife Crime (ICCWC)	

Course Code 24BPBW4T02	Course Title Human Wildlife Conflicts and Mitigation	Credits 04	No. of lectures 60

Course Outcomes:

At the end of the course students will be able to:

CO 1	Examine human-wildlife conflict through its historical, ecological, and socio-economic dimensions	L4
CO 2	Assess socio-economic impacts and policy interventions in human-wildlife conflict.	L5
CO 3	Appraise sustainability strategies for fisheries, forestry, and alternative energy use.	L5
CO 4	Explore eco-tourism planning, community involvement, and environmental awareness.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	1	3	2	2
CO 2	3	2	1	3	2	3
CO 3	3	2	1	3	2	3
CO 4	3	2	1	3	3	3

Unit I:	**Causes of Human Wildlife Conflict**	**15**
	● Introduction to Human-Wildlife Conflict - Definition, Scope and Significance ● Historical and Cultural aspects ● Conflict or Coexistence? ● Habitat loss and fragmentation ● Competition for resources (eg; food, water, space) ● Crop raiding and Livestock predation ● Human encroachment into wildlife habitats ● Impacts of climate change	
Unit II:	**Human-wildlife conflict impacts, management and policy**	**15**
	● Economic consequences for local communities, farmers, and wildlife conservation efforts ● Threats to human livelihoods and food security ● Conservation implications and effects on wildlife populations ● Human injuries and fatalities resulting from conflicts with wildlife ● Legal frameworks and policy interventions to address human-wildlife conflict ● Institutional arrangements and governance structures ● Role of NGOs, government agencies, and community-based organizations in conflict management ● Participatory approaches and conflict resolution mechanisms	

Course Code 24BPBW4T03	Course Title Wildlife Forensic Science	Credits 04	No. of lectures 60
	• Sustainability of Natural resources • Natural Resource Management (with special reference to Fisheries & Forestry) Regulations on fishing • Estimating sustainability of fish populations Concept of MSY in marine resources • Regulating forest usage & Minor Forest Produce : Controlled logging and Non Timber Forest Produce (e.g. grazing at Keoladeo / Gir, Fishing in Sunderbans, Mahua collection in Kanha, Tendu (*Diospyros melanoxylon*) leaves collection in Central Indian protected areas etc.) in and around various sanctuaries and national parks in India. • Alternate energy sources, their applications and practice		
Unit IV:	**Eco-tourism**		**15**
	• Scope of Eco tourism in India • Hospitality & Logistics in Eco-tourism • Planning and executing Eco-tourism • Customized Eco-tours (e.g. Bird watching, Adventure Tourism, Agro-tourism) • Local community's participation in Ecotourism • Public awareness & Interpretation towards environment Orienting • Corporate Social Responsibility towards environment		

Course Outcomes:

At the end of the course students will be able to:

CO 1	Explain the scope, role, and fundamental techniques of wildlife forensics in supporting wildlife law enforcement and traceability.	L2
CO 2	Discuss DNA analysis, safety protocols, and specimen handling and transport in wildlife crime investigations.	L2
CO 3	Outline the methods and applications of forensic identification in ornithology, palynology, and botany.	L2
CO 4	Summarize the roles of national and international agencies in wildlife forensics.	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	1	3	2	3
CO 2	3	3	2	3	2	3
CO 3	3	3	2	3	2	3
CO 4	3	2	1	3	3	3

Unit I:	**Introduction to Wildlife Forensics**	**15**
	● General introduction, concept & scope ● Role of forensics within wildlife law enforcement ● Techniques used in wildlife forensics - introduction ● Applications of wildlife forensics- Casework, Traceability, Intelligence	
Unit II:	**Forensics in wildlife crime investigation**	**15**
	● DNA analysis - Sample types for identification, species identification, individual identification, familial identification, identification of geographical locations ● Health and safety measures ● Collection & preservation of wildlife specimen - taxidermy, cryopreservation, chemical preservation ● Transportation of wildlife specimen, specimen shipment	
Unit III:	**Forensic Ornithology, Palynology and Botany**	**15**
	● Species identification from feathers and eggs, analysis of artifacts, case studies - artifacts of ivory, shells, scales ● Role of palynomorphs in forensic investigation - NPC analysis, analysis of pollen and spores, diatoms ● Identification of wood, dendrochronology, case study - trafficking of Chandan, Narkya	
Unit IV:	**Forensic Agencies and Organizations**	**15**

	● The Society for Wildlife Forensic Science (SWFS), Wildlife Forensic Academy ● Organizations involved in supporting development of wildlife forensics - The Society for Wildlife Forensic Science, TRAFFIC etc. ● Institute of Forensic Sciences, Fort, Mumbai	

SEMESTER IV
ELECTIVE I

Course Code 24BPBW4T04	Course Title Eco Journalism and Eco Literacy	Credits 02	No. of lectures 60

Course Outcomes:

At the end of the course students will be able to:

CO 1	Examine environmental issues, governmental agencies, and the role of RTI in eco journalism.	L4
CO 2	Justify engaging with affected communities and utilizing mass media for environmental reporting	L5
CO 3	Identify the need, scope, and target audience for environmental education	L3
CO 4	Evaluate environmental education techniques using classroom methods, field activities, and issue-based awareness programs.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	1	3	2	3
CO 2	3	2	2	3	3	3
CO 3	3	2	1	3	2	3
CO 4	3	2	2	3	3	3

Unit I:	**Environmental Journalism**	**15**
	• Investigating environmental issues • Important Governmental agencies • RTI and its judicious use • Interacting with affected people • Mass media and its role e.g books – Silent spring, Small is beautiful films – Home (BBC documentary), An Inconvenient truth, Beautiful people • Reporting Environmental issues	
Unit II:	**Environmental Education Techniques**	**15**
	• Need & scope of Environmental Education • Identifying Audience & their needs Children, General public, Decision makers • Techniques in environmental education Class-room techniques (examples) - Talks, Nature games, role playing, models, Competitions, songs, drama, mass-media etc. • Field techniques For e.g. Surveys, Street plays, demonstrations, Art Cultural practices, exhibitions etc. • Environment education on specific issues (Examples); For e.g. Smokeless chulhas, solar cooker, biogas plant, cattle immunization etc.	

Course Code 24BPBW4P01	PRACTICALS BASED ON 24BPBW4T04	Credits 02

Course Outcomes:

At the end of the course students will be able to:

CO 1	Evaluate natural resource use and impacts through field surveys and statistical tools.	L5
CO 2	Create conservation awareness through audio-visual communication tools.	L6
CO 3	Design educational eco-resources like nature trails and tour plans.	L6
CO 4	Review documentaries and interview experts to understand conservation practices.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	2	3	2	3
CO 2	3	2	3	3	3	3
CO 3	3	2	2	3	3	3
CO 4	3	2	2	3	3	3

1. Undertake a survey of Fishermen's village / Tribal village near forest. Use a suitable questionnaire
   - to record the extent of dependence of the community on the natural resource base,
   - to record their pattern of usage of the natural resource,
   - to document the anthropogenic influences on the ecosystem and
   - to suggest ameliorative measures including environment awareness programmes. Apply suitable Statistical tools for tabulating, representing and evaluating both quantitative and qualitative data obtained during the survey. Interpret the results and prepare a report and submit*.

(* Report to be produced at the time of examination for evaluation by examiner).

2. Prepare an audio-visual presentation to communicate conservation to the youth & general public on some environmental issues (Eg. Destruction of local biodiversity sites like mangrove or sea shore or a forest patch, Human-wildlife conflict, Developmental activity that has potential threat to local biodiversity etc.) ** Students can use open source software to create audio visual presentations.
3. Design a self-guided trail for a nature reserve / biodiversity park and submit a report
4. Prepare a plan, itinerary & brochure for an eco-tour for place of Natural History / Adventure tourism / Agro tourism (maximum three days & two nights, excluding travel)
5. Wildlife Documentary review
6. Interview of researcher/environmentalist/social activist/government official

Course Code 24BPBW4T05	Course Title Biodiversity and Artificial Intelligence	Credits 02	No. of lectures 60

Course Outcomes:

At the end of the course students will be able to:

CO 1	Explain the concepts and applications of AI and machine learning in biodiversity studies.	L2
CO 2	Discuss AI-driven biodiversity monitoring, including data types and automated species identification systems.	L2
CO 3	Outline the role of AI in the policy-making process for biodiversity conservation, including identification, formulation, adoption, implementation, and evaluation.	L2
CO 4	Examine case studies on the application of AI in conservation practices such as sustainable fishing, coral reef restoration, and air pollution reduction.	L4

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	2	3	2	2	3
CO 2	3	3	3	3	2	3
CO 3	3	2	3	3	3	3
CO 4	3	3	3	3	3	3

Unit I:	**Using AI to understand biodiversity**	**15**
	• Definition of AI, Machine learning - Supervised, Unsupervised, Semi-supervised, • AI for Biodiversity • Data types used in AI driven biodiversity monitoring - Mobile sensors, Stationary sensors • Automated species identification - The Distributed System of Scientific Collections (DiSSCo), Deep voice foundation etc.	
Unit II:	**Using AI to conserve biodiversity**	**15**

	• Role of AI in policy making -
	  • Identification
	  • Formulation,
	  • Adoption,
	  • Implementation,
	  • Evaluation
	• Case studies
	  • AI for sustainable fishing,
	  • AI for coral reef restoration,
	  • Using AI to reduce air pollution in Uganda	

Course Code 24BPBW4P02	PRACTICALS BASED ON 24BPBW4T05	Credits 02

Course Code 23BPBW4RP3	Course Title RESEARCH PROJECT– II based on Biodiversity, Wildlife Conservation and Management	Credits 06	No. of Hours: 180

Course Outcomes:

At the end of the course students will be able to:

CO 1	Formulate relevant research questions and hypotheses for a selected field problem.	L6
CO 2	Design appropriate methodologies and sampling techniques for data collection in the field.	L6
CO 3	Analyze the collected field data using suitable statistical tools.	L4
CO 4	Discuss the research findings effectively through reports and oral presentations.	L6

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	3	3	2	3
CO 2	3	3	3	3	2	3
CO 3	3	3	3	3	2	3
CO 4	3	3	3	3	2	3

Grading will be as follows: 3: High (>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

1) Analyze bird species diversity in a specific area and to classify and identify different bird species based on their characteristics using AI algorithms - Merlin

2) Species identification: Utilize AI tools for species identification, such as image recognition software, to help learn about different species and their characteristics - iNaturalist, eBird

3) Develop conservation plans for protecting biodiversity hotspots or endangered species using AI - Normalised Difference Vegetation Index (NDVI)

4) Using AI for monitoring and surveillance of wildlife populations, such as using drones and AI algorithms to track animal movements - Deep learning (case study)

5) Create simulation models using AI to study the impact of environmental changes on biodiversity and ecosystems (case study)
**demonstration of various AI tools along with identification and case study for above practicals

	presentations.	

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	2	1	2	3
CO 2	3	3	2	2	3	3
CO 3	3	3	3	2	2	3
CO 4	3	3	3	2	3	3

General Guidelines

- The RP topic may be undertaken from any topic relevant to biodiversity, ecology, conservation and allied subjects with precise objective
- Each student has to undertake a RP individually based on field and/or laboratory work
- Students must remain present at the time of review meeting scheduled by research guides
- Structure of dissertaion report should contain the following chapters: Title, Abstract, Aim, Objective and Rationale, Introduction, Literature review, Methodology, Study Area, Observations, Result, Conclusion, Discussion, Bibliography
- Student should prepare a powerpoint presentation of research project and it should be presented in front of respective examiner
- Duly signed hard copy of dissertaion and PPT should be submitted to the Department/college

SUGGESTED READINGS

Sr. No.	Title	Author	Publisher	Year
1.	Protected Area Update; Newsletter	---------	Kalpavriksh Environment Action Group, Pune , India	Periodical
2.	Zoos in India; Legislation, Policy, Guidelines and Strategy	----------	Central Zoo Authority, New Delhi	2007
3.	Wildlife ecology	Aaron, N.M.	W.H. Freeman Co. San Francisco, U.S.A.	1973
4.	The Book of Indian Birds	Ali, Salim	Oxford University Press, Mumbai	1997
5.	Wildlife Ecology, Conservation and Management	Anthony R.E. Sinclair, John M. Fryxell and Graeme Caughly	Blackwell Publishing, U.S.A.	2006
6.	The Book of Indian Shells.	Apte, Deepak.	Oxford University Press, Mumbai.	
7.	Indian Wildlife Yearbook	Arora B. M. , Editor	AIZ & WV, Bareilly and Central Zoo Authority, New Delhi	2002
8.	Rehabilitation in free living wild animals	Arora, B.M.	AIZ & WV, Bareilly	2007
9.	Reproduction in Wild Mammalia & Conservation	Arora, B.M.	AIZ & WV, Bareilly.	2002
10.	People and wildlife, conflict or co-existence?	Woodroffe, R., Thirgood, S., & Rabinowitz, A.	5th Edition. Cambridge University Press	2005
11.	Remote Sensing for Hazard Monitoring and Disaster Assessment	Barett, E.C. and Anton Micallef	Taylor and Francis, London	1991
12.	Statistics in Research	Bernard Ostle and R.W.Mensing		
13.	Wild Animals in Central India	Brander, A.A	Natraj Publisher, Dehradun.	
14.	Method of Statistical Analysis	C.H. Goulden	John Wiley & Sons	
15.	Environmental Impact Assessment	Canter, L. W.	Graw, Mc, , Hill Publication, New York.	
16.	Introduction to Geographic Information Systems,	Chang – Kang, Tsung	Tata McGraw -Hill Publishing Company Limited, New Delhi	2002
17.	A guide to Chemical Restraint of Wild Animals.	Chowdhury, Sushant and Malik, Pradeep	Natraj Publishers, Dehradun.	
18.	EIA – A Biography	Clark, B. D., Bissel, B. D. and Watheam, P.	School of Forestry and Environment, SHIATS- Deemed University, Allahabad	
19.	The Temple Tiger.	Corbett, Jim	Oxford University Press, New Delhi	2007

Sr. No.	Title	Author	Publisher	Year
20.	Asian Elephant,	Daniel, J.C.	Natraj Publishers, Dehradun	
21.	The Book of Indian Reptiles and Amphibians	Daniel, J.C.	Oxford University Press, Mumbai.	
22.	Resource and Environmental Economics	Fisher, A.C.	New York: John Wiley & Sons	1979
23.	The conservation of plant biodiversity.	Frankal, Otto H., Anthony, A., Brown, D. and Burdon, Jeremy J.	Cambridge University Press	1995
24.	Statistical Methods	G.W. Snedecor and W.G. Cochran		
25.	The Serengeti Lion	George B. Schaller		
26.	Fundamentals of Wildlife Management	Gopal, Rajesh	Justice Home, Allahabad, India.	1992
27.	Encyclopedia of mammals	Grzimek	McGraw Hill Publishing House, New Delhi.	1988
28.	Wild Animals, Their Minds and Manners	Hornaday, W.T.	IBD, Dehradun.	1989
29.	Concepts in Wildlife Management	Hosetti, B.B.	Daya Publishing House, Delhi.	1997
30.	Collection and preservation of animals	Jairajpuri M. S.	Zoological Survey of India	1990
31.	Statistical Ecology	John A. Ludwig & James F. Reynolds	John Wiley & Sons	1988
32.	Handbook of Environment, Forest and Wildlife Protection Laws in India	Justice Kuldip Singh	Natraj Publishers, Dehradun	1998
33.	Biodiversity conservation in managed and protected areas	Katwal/Banerjee	Agrobios, India	2002
34.	Advances in Fish and Wildlife Ecology and Biology	Kaul, B.L.		1999
35.	A Vet in Wilderness	Khan Ali M. G.	Central Zoo Authority, New Delhi	
36.	Remote Sensing and Image Interpretation	Lillesand, T.M. and Kieffer, R.W	John Wiley and Sons	
37.	Wild Animals of India, Burma, Malaya and Tibet	Lydekker, R.,	Natraj Publishers, Dehradun.	

Sr. No.	Title	Author	Publisher	Year
38.	Wildlife Crime	Menon, Vivek and Kumar, Ashok	Natraj Publisher, Dehradun.	1999
39.	Wildlife Issues in a Changing World	Moulton, M. P. & J. Sanderson	St. Lucie Press	1997
40.	A handbook of forestry.	Negi, S.S.	International Book Distributor, Dehradun.	2005
41.	Biodiversity and its conservation in India	Negi, S.S.	Indus Publishing Co., New Delhi.	1993
42.	Manual for Wildlife Management in India	Negi, S.S.		
43.	Fundamentals of Ecology	Odum, Eugene P	Natraj Publishers, Dehradun.	
44.	Applied Anatomy of Domestic Animals.	Ommer, P.A. and Harshan, K.R.	Jaypee Brothers Medical Publishers (P) Ltd., New Delhi.	
45.	Natural Resource Information for Economic Development	Orris C. Herfindahl	Baltimore: The Johns Hopkins University Press	1969
46.	Watching and Conserving	Oxford Anthology of Indian Wildlife	Oxford University Press, New Delhi.	
47.	Aerial Photography and Image Interpretation for Resource Management.	Paine, D.P.	John Wiley and Sons.	
48.	The Ecology of Wildlife Diseases.	Peter J. Hudson, Annapaola Rizzoli, Bryan T. Grenfell, Hans Heestrbeek and Andy P. Dobson	Oxford University Press, Oxford	2002
49.	Book of Indian Animals.	Prater, S.H.	Bombay Natural History Society, Mumbai.	
50.	Essentials of Conservation Biology	Primack, R.B.	Sinauer Associates, Inc. Sunderland, MA	1998
51.	Principles and Procedures of Statistics (with special reference to Biological Sciences)	R.G. Steel and J.H. Torrie		
52.	A TextBook of Agricultural Statistics	R.Rangaswamy		
53.	Birds of Wetlands and Grasslands	Rahmani, Asad R. & Ugra, Gayatri	Bombay Natural History Society, Mumbai.	
54.	A Handbook of the Management of Animals in Captivity.	Ram Brahma Sanyal		1995

Sr. No.	Title	Author	Publisher	Year
55.	Wildlife management.	Robert, G.H.	W.H. Freeman and Co., San Francisco, U.S.A.	1978
56.	The Care and Feeding of Infant Orphaned Wild Birds.	S.M.L. Grose.	IBD, Dehradun	
57.	Remote Sensing: Principles and Applications	Sabbins, F.E., Freeman		
58.	Manual of wildlife techniques for India.	Sale, J.B. and Bergmuller, K.	WII, FAO, DehraDun, India	1988
59.	A Handbook of the Management of Animals in Captivity.	Sanyal, Ram Brahma		1995
60.	Indian Wildlife Resources Ecology and Development	Sharma, B.D	Daya Publishing House, Delhi	1999
61.	A New Approach to Linear Programming	Sharma, S.D.	Kedarnath, Ramnath and Co. Meerut	1975
62.	Wildlife Ecology, Conservation and Management	Sinclair, Anthony R.E., Fryxell, John M. and Caughey, Graeme	Blackwell Publishing, U.S.A.	2006
63.	Economics of PA's and its effect on biodiversity.	Singh and Vijaykumar.	APH Publishing Corporation, New Delhi.	2001
64.	Text Book of Wildlife Management.	Singh, S.K.	IBDC, Lucknow.	2005
65.	Conserving India's Natural Heritage	Singh, Samar	Natraj Publication, DehraDun.	1987
66.	Wildlife and Forest Conservation	Sinha, P.C.	Anmol Publishing Pvt. Ltd., New Delhi.	1998
67.	Mammals Skin.	Sokolov, V.E.	IBD, Dehradun.	1982
68.	Wildlife research and management. Asian and American Approaches	Stephen, H.B. and V.B. Saharia	Oxford University Press, Delhi	1995
69.	Zoogeography of India and Asia.	Tiwari, S.K.	CBS Publisher and Distributors, New Delhi.	
70.	Natural Resource and Environmental Economics	Tony Prato,	Iowa State University Press	1998

Sr. No.	Title	Author	Publisher	Year
71.	Environmental and social impact assessment	Vanclay F. and Bronstein, D.A.	John Wiley & Sons, New York.	1995
72.	Guide for Planning Wildlife Management in Protected Areas and Managed Landscapes	Vishwas Sawarkar	Natraj Publisher. Dehradun	
73.	Experimental Designs	W.G. Cochran and G.M.Cox		
74.	Apala Paryavaran	Paryavaran Dakshata Mandal		
75.	Intellectual Property Rights	Jyoti Raman	Bharat Law House	2024
76.	Intellectual Property Rights Manual	Saurabh Bindal	1st Edition, Eastern Book Company	2023
77.	Trade Marks Act, 1999 Bare Act		19th Edition, Eastern Book Company	2024
78.	Bioacoustics and Artificial Intelligence for Biodiversity Conservation	Garima Singh, Sachin Kumar		2023
79.	Proposing Central Asian AI Ethics Principles: A Multilevel Approach for Responsible AI	Ammar Younas Yi Zeng		2024
80.	Artificial intelligence and conservation.	Fang, F., Tambe, M., Dilkina, B., & Plumptre, A. J.	Cambridge University Press.	2019
81.	Wildlife forensics: methods and applications.	Jane Huffman John Wallace	John Wiley & Sons.	2012
82.	Forensic science in wildlife investigations.	Adrian Linacre	CRC press	2009
83.	Wildlife DNA Analysis: Applications in Forensic Science	Adrian Linacre Shanan Tobe	Wiley	2013
84.	Human–wildlife interactions: turning conflict into coexistence	Beatrice Frank, Jenny Glikman. Silvio Marchini	Cambridge University Press.	2019

Evaluation Scheme 60:40 (Subjected to change to 50:50 as per new guidelines of NEP)
Internals Based on Unit 1 / Unit 2 / Unit 3/ Unit 4

Assignments/ Tutorials/ Class test	Seminar or other activities	Ppt/video Presentation or other activities	Group discussion / book review or other activities	Active Participation & Leadership qualities	Total
10	10	10	05	05	40

Theory Examinations: For Paper 1, Paper 2, Paper 3 and Research Methodology
Suggested Format for MAJOR Question paper

23BPBW_T0_/0_/20__				
Duration: 02 hr. 30 min				**Total Marks: 60**
N.B.				
1.	**All questions are compulsory**			
2.	**Draw neat labeled diagram wherever necessary**			
3.	**All questions carry equal marks**			
Q.1.	**(A)**		**Attempt any one**	**8**
		(I)	Based on Unit 1	
		(II)	Based on Unit 1	
Q.1.	**(B)**		**Attempt any one**	**7**
		(I)	Based on Unit 1	
		(II)	Based on Unit 1	
Q.2.	**(A)**		**Attempt any one**	**8**
		(I)	Based on Unit 2	
		(II)	Based on Unit 2	
Q.2.	**(B)**		**Attempt any one**	**7**
		(I)	Based on Unit 2	
		(II)	Based on Unit 2	
Q.3.	**(A)**		**Attempt any one**	**8**
		(I)	Based on Unit 3	
		(II)	Based on Unit 3	
Q.3.	**(B)**		**Attempt any one**	**7**

		(I)	Based on Unit 3	
		(II)	Based on Unit 3	
Q.4.	**(A)**		**Attempt any one**	**8**
		(I)	Based on Unit 4	
		(II)	Based on Unit 4	
Q.4.	**(B)**		**Attempt any one**	**7**
		(I)	Based on Unit 4	
		(II)	Based on Unit 4	
			**********	

Theory Examinations: For ELECTIVE Paper

23BPBW_T0_/0_/20__				
Duration: 01 hr. 30 min				**Total Marks: 30**
N.B.				
1) All questions are compulsory				
2) Draw neat labeled diagram wherever necessary				
3) All questions carry equal marks				
Q.1.	**(A)**		**Attempt any one**	**8**
		(I)	Based on Unit 1	
		(II)	Based on Unit 1	
Q.1.	**(B)**		**Attempt any one**	**7**
		(I)	Based on Unit 1	
		(II)	Based on Unit 1	
Q.2.	**(A)**		**Attempt any one**	**8**
		(I)	Based on Unit 2	
		(II)	Based on Unit 2	
Q.2.	**(B)**		**Attempt any one**	**7**
		(I)	Based on Unit 2	
		(II)	Based on Unit 2	
			**********	

Semester End Practical Examination:
Practical examination of each paper for 50 marks will be held for three and half hours

Semester ____ Practical Examination "Month & Year"
Paper Code:- _____

Total Duration: - 03.½ hrs. **Total Marks**: - 50

Distribution of marks
Question 1 - (performance & result/identification) – 20 marks
Question 2 - (performance & result/identification) – 10 marks
Question 3 - (identification) – 10 marks
Question 4 - (viva voce) – 05 marks
Question 5 - (journal/field report) – 05 marks

Marks Distribution and Passing Criterion for Each Semester

Theory						Practical		
Course Code SEM III / SEM IV	Internal	Min marks for passing	Theory Examination	Min marks for passing	Total	Course Code	Practical Examination	Min marks for passing
24BPBW3T01/4T01	40	16	60	24	100	-	-	-
24BPBW3T02/4T02	40	16	60	24	100	-	-	-
24BPBW3T03/4T03	40	16	60	24	100	-	-	-
Laboratory 1	-	-	-	-	-	24BPBW3P01	**50**	**20**
24BPBW3T04 or 3T05/4T04 or 4T05	20	08	30	12	50			
Laboratory 2	-	-	-	-	-	24BPBW3P02 or 3P03/4P01 or 4P02	**50**	**20**
						24BPBW3P03 (Research Project - 4 credits)	**100**	**40**
						24BPBW4P03 (Research Project - 6 credits)	**150**	**60**

Pedagogy for student engagement is predominantly lectures. However, other pedagogies enhancing better student engagement to be recommended for each course. The list includes active learning/ course projects/ problem or project-based learning/case studies/self-study like seminar, term paper or MOOC

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